readers of this paper to have quoted in connection with the present sketch, the experience of the late Philip Henry Gosse, Esq., published in March, 1847. On page 400 of 'The Birds of Jamaica,' the author speaks of the only Tropic Bird he was aware of under the head of *Phaëthon æthereus* Linn.—a single bird which he "presumes to have been an immature individual"; and says further: "It is mentioned to me as one of the constant frequenters of the Pedro Kays." This is the only individual from the mainland that came under the notice of this very careful observer, and it is the more curious, inasmuch as Mr. Gosse resided, while in Jamaica, on the sea coast. In speaking of his work, on page 70 of his 'Birds of Jamaica' he says, "Every day through the winter months, my almost undivided attention was given to birds; and . . . . from August to April about thirteen hundred specimens of birds fell into my hands, more than one thousand of which were shot by myself and my servants." The Pedro Kays mentioned are four small islands, situated some forty to fifty miles southwest of Portland Point on the south coast of Jamaica. It seems hardly probable, that the Yellow-billed Tropic Bird could have been as common in Gosse's day as now, for so conspicuous a species as it is at present could hardly have escaped the observation of so keen a worker, aided as he was by friends in almost every part of the island, the parish of Portland being referred to many times in his work. In reviewing in the present series of papers the work that has been accomplished during the past winter, I shall have occasion from time to time to make further comparisons, for the very accurate records left by Mr. Gosse form a basis for such work, and elements have entered into the fauna of the Island that have greatly modified the avifauna as it existed a little more than fifty years ago.

YELLOW-BELLIED WOODPECKERS AND THEIR UNINVITED GUESTS.

BY FRANK BOLLES.

Of the seven species of Woodpeckers which I have found in the region of Mt. Chocorua, New Hampshire, the Yellow-bellied

or Sapsucker is the most numerous. It may fairly be said to be abundant in that district. I base this statement upon my daily count of birds seen between April and the middle of October in the years 1889 and 1890. I frequently record seeing from seven to ten of these birds in a day. Their favorite haunts are mixed growths of young birch, larch, hemlock, maple and white ash bordering water or wet lands.

My attention has been drawn to the Yellow-bellied Woodpeckers on two accounts:—their quickness to observe and persistence in scolding my tame Owls when in the woods; and their destruction of certain forest trees.

Last summer I was led to spend a considerable time in close study of these Woodpeckers and their feeding habits by the peculiar relations which I noticed as seeming to exist between them and Hummingbirds. My observations were given point by my recollection of the difference of opinion among ornithologists regarding the diet of these Woodpeckers and their motive for tapping sap-yielding trees. I had heard it said that their sole reason for drawing the sap was to attract insects which they then fed upon. I had also heard that they ate the tender cambium layer which intervenes between the bark and inner wood of trees. I knew well that the birds were insect-eaters for I had often seen them fly into the air with the grace of a Tyrant Flycatcher or Cedarbird and capture insects on the wing.

On July 19, 1890 while watching a group of birds gathered in the woods around my tame Owl, Puffy, two Yellow-belliedWoodpeckers and a Hummingbird attracted my attention. The Woodpeckers were scolding the Owl, when the Hummingbird darted towards one of them, hummed before it, rushed at the other, and then seeing the Owl flew at him squeaking furiously. Then it flew back to the first Sapsucker and perched near it. On the 21st I returned to the spot and found near by a Sapsucker's 'orchard' of about a dozen canoe birches and red maples, most of which were dead, some decayed and fallen. The tree most recently tapped was a red maple about forty feet high and two feet through at the butt. The drills made by the Woodpeckers began eighteen feet from the ground and formed a girdle entirely around the trunk. This girdle contained over 800 punctures and was about three feet in height. In places the punctures or drills had run together causing the bark to gape and show dry wood within.

The upper holes alone yielded sap. From this I inferred that what the birds obtained was the elaborated sap descending from the leaves through the fibres of the inner bark. I tasted the sap and found it unmistakably sweet. The leaves on branches above the drills drooped, those below were in good condition. I watched the drills on this tree from 12.30 P.M. until 2, and from 4 until 6. I was concealed in the bushes to the northwest of the tree. During almost all of this period of three and a half hours one or more Woodpeckers were in the tree engaged at the drills. They were a male, female and two young birds. Four visits were paid by Hummingbirds in the time named. The visitors were driven away by the Woodpeckers. At 5.30 I shot one of the young birds in order to determine the number of individuals using the orchard. His absence was unnoticed by the survivors.

The next day, July 22, I watched from 9.30 A.M. until 1 P.M. The male, female and one young bird were present, the tree being seldom left by all at once. Ten visits were paid by Hummingbirds; in five cases the birds reached the drills, and hovering, drank sap from one or more of them. In the other cases, the Woodpeckers being present, the Hummers were driven away. The work of the Woodpeckers seemed to me, armed as I was with an excellent opera glass, and sitting not more than thirty feet from the drills, to be perfectly plain in character. During the morning the female drilled four or five new holes. They were above others in perpendicular series. They yielded sap freely. She was closely attended by the young one, who occasionally swallowed pieces of the soft bark or cambium layer taken from the bottom of the drills. The female also ate some of it. When not drilling or resting the female dipped sap from the holes near by. The male drilled no holes but dipped in those yielding sap. The dipping was done regularly and rather quickly, often two or three times in each hole. The sap glistened on the bill as it was withdrawn. I could sometimes see the tongue move. The bill was directed towards the lower, inner part of the drill, which, as I found by examination, was cut so as to hold the sap. I looked carefully again and again to try to find insects in the sap, but none were there although numbers crawled upon the bark. Occasionally the birds by a nervous motion of the head caught an insect. There was no doubt as to when they did this, either on the bark or in the air, for in swallowing an insect they always occupied an appreciable time in the process.

During the forenoon I nailed to the tree near the drills two tiny cups of birch bark. These I filled with maple syrup. The birds, although not disturbed by these cups, did not then drink from them. In the course of the morning I shot a Crow and two Blue Jays from where I sat, but the Sapsuckers, although greatly startled by the reports, returned quickly after their first fright.

The day following, July 23, I was on duty at the tree from 9 A.M. until 12.30 P.M. I lay on the ground concealed by the spreading branches of a beech tree; my watch hung from a twig before my eyes, while equipped with pencil and paper, I took notes of all that occurred from minute to minute throughout the day. My record runs as follows:—

Wednesday, July 23, 9 A.M. Arrive, climb tree, fill cups, male Sapsucker comes, scolds, goes off. No insects in the sap.
9.08. Male returns, dips from six holes.
9.09. Goes out on dead limb.
9.11. Hummer takes sap from two holes. I could hear no humming. Male quiet.
9.15. Young Woodpecker comes.
9.17. Goes out on limb, having dipped 37 times in 9 holes. Male flies.
9.20. Young dips 39 times from 13 holes.
9.22. Goes out on limb.
9.26. Male comes, dips 15 times from 9 holes.
9.27. Male drills a new hole. Hummer comes and goes; gets nothing.
9.28. Young flies north.
9.30. Male catches insect on the wing, goes on limb. Catches another insect on wing.
9.32. Hear a Hummer. Male drums.
9.34. Male dips from four holes. Flies west.
9.44. Male returns, dips 9 times, 7 holes, goes on limb—drums, preens.
9.47. Hear drumming.
9.50. Female comes from north, they chatter. Male flies north.
9.51. Female dips, goes on further side of tree and drills.
9.52. Comes to cups, tastes syrup in one.
9.53. Flies away, east.
10.01. Male comes from north, dips 17 times, 12 holes.
10.03. Flies north. Hear a Hummer.
10.09. Female comes from east, dips in drills and then from cup No. 1, 4 times.
10.10. Flies east.
10.37. Female comes.
10.38. Male comes. Female dips 4 times in cup No. 1 and goes east.
10.39. Male dips in 5 holes, taps on bark, preens.
10.42. Goes out on limb, scratches and preens. Seems to have lice.

10.45. Young comes.
10.47. Male goes to another tree, undrilled and begins drilling. Young dips in 40 drills.
10.48. Hummer comes. Young drives it off.
10.50. Young stands on cups and dips in a few holes many times.
10.53. Still dipping from same holes.
10.57. Still dipping at intervals.
10.58. Male comes, nervous, drills.
10.59. Young tries to drill, four feet above drills.
11.02. Male and young both drilling.
11.06. Male dips, goes out on limb.
11.10. Young dips.
11.15. Male dips, goes back on limb, flies east.
11.16. Young dips from cup No. 3 and from new holes.
11.17. Young digging in old holes.
11.19. Young dips from holes and dips twice in cup No. 3.
11.20. Goes on limb.
11.22. Dips from holes just made by male.
11.25-11.30. Still dipping at intervals.
11.32. Male comes from east. Young goes.
11.33. Male drills.
11.35. Looks at cup. Goes out on limb.
11.37. Catches insect on wing, brings it to the tree, crowds it into hole, and eats it piece-meal.
11.38. Female comes. Goes direct to cup No. 1 and dips 4 times.
11.40. Female dips in new hole and drills one.
11.47. New hole done, after 6½ minutes hard chiselling.
11.49. She catches insect on the wing, puts it in a hole and eats it.
11.50. Hear a Hummer.
11.52. Female drills.
11.55. Dips, goes on limb, wipes beak and preens.
12 noon. Female completes toilet, dips and flies away.
12.05-12.10 I examine tree. What appeared to be drilling new holes was mainly clearing dry wood from existing drills and running several drills into one large one. The drills are always lower at the back next the wood than at the front, thus forming cups for the sap to collect in. The holes begun by the young did not reach the cambium layer. I find no insects in sap or syrup.
12.23. Female comes from north, dips, pecks and preens.
12.27. On limb preening.
12.30. Still there. I go home for dinner.
2.30. Return. Young in tree. I climb, he flies. I place a flame-colored nasturtium above cup No. 1.
2.37. Female comes, dips in new holes.
2.38. Sees nasturtium—petrified by astonishment.
2.39. Hitches towards flower, and touches it three times, with her bill. Satisfied, dips.

2.40. Drills and later does nothing.
2.48. Catches an insect on the bark by a quick pecking motion. Goes on limb.
2.51. Young comes, dips. No notice of nasturtium.
2.53. Young goes on limb. Female comes in and drills.
2.54. Young comes in and walks over nasturtium.
2.55. Female drinks from both cups, bill glistens.
2.57. Both fly. Young seems color blind.
2.58. Male comes, dips, goes near flower, does not notice it it all.
3. Male preens, clinging to bark.
3.01. Female returns. Male dips. Both preen.
3.09. Male dips.
3.13. Male hops to nasturtium and touches it with bill three times. Looks at cup but dips in holes.
3.15. Nasturtium blows away.
3.19. Male dips. Female drinks 17 times from cup No. 1 and once from a drill.
3.22. Male sleepy, dips now and then. I peep, mew, whistle, hoot, bark and talk, but no sound makes the birds do more than move their heads.
3.28. Hummer comes; sees male and retreats.
3.29. Male dips.
3.30. Female flies east.
3.33. Male dips and goes on limb.
3.37. Male hangs wings and opens beak. Sits in sun.
3.42. Preens, comes in and dips, goes back.
3.47. Young comes, dips 30 times. Male goes on limb.
3.52. Hummers near, male comes in, very lively, dips.
3.56. Male drills. Young stays close to him.
3.58. Young goes on limb and hangs his wings down each side, so they show underneath the limb.
3.59. Male goes on limb.
4. Male comes in and tries to catch passing flies.
4.02. Young wakes and preens.
4.04. Male begins new hole.
4.05. Male goes on limb. Young dips.
4.07. Young drinks 4 times from cup No. 3.
4.08. Male dips. Young goes on limb.
4.10. Male goes out.
4.13. Male comes in and dips.
4.17. Young flies in, male goes out. Young dips 48 times from drills.
4.25. Both quiet.
4.27. Male comes in. Young dips.
4.30. Male drills new hole higher up.
4.35. Young flies east.
4.40. Young comes from east, dips, male dips.
4.50. Male and young dipping.

4.55. I squeak, Hummer flies in and alights.
4.59. Female has been gone 90 minutes.
5. Male motionless. Young in next tree.
5.06. Male dips and flies away on seeing me.
5.07. Young comes in and dips 16 times from cup No. 3.
5.13. After dipping in holes goes to cup and dips 5 times.
5.14. Female comes from south, young flies south.
5.15. Female touches cup 3, then goes to cup 1 and dips 13 times.
5.16. Goes out on limb.
5.20. She drills, and continues to drill a long time.
5.35. Hummer comes, alights, flies away.
5.36. Young comes and dips. Female goes.
5.38. Young dips 7 times in cup No. 3, then in several new holes.
5.41. Male comes.
5.44. Young dips in cup No. 3, 7 times, flies off.
5.46. Male rattles around over cups and bark, but thus far I have not seen him drink from cups.
5.49. Young returns, dips 3 times from cup 3. He always wipes his bill in a drill after drinking syrup.
5.55. Young dips again in cup 3 and flies south.
5.56. Male flies in and clings close to cup.
6. Hummer near.
6.02. Male dipping and preening.
6.08. Young comes from south.
6.12. Male and young dipping.
6.18. A Hermit Thrush alights on the limb from which the Woodpeckers always take flight. Young flies at him twice and drives him away and out of the tree.
6.30. Young still dipping; I go home.

On July 24 instead of going to 'Orchard No. 1' as I shall call that already described, I went first to another half a mile northeast of it, where, in August, 1889, I had seen Sapsuckers drilling a canoe birch, and Hummingbirds and a Downy Woodpecker apparently sharing in the profits of the tree.

I reached Orchard No. 2 at 6.45 A.M. The tree in use last year was nearly dead. Two neighboring birches showing scars of earlier years were quite dead. All stood on the crest of a kame. About three rods along the ridge to the eastward a red oak and two or three canoe birches were in use by the birds. Five Sapsuckers including a male, female and three young were frolicking and dipping. The male was somewhat rough with the young birds. I stayed until 7.30. Hummingbirds made thirteen visits in that time and were generally allowed to dip freely. A Black-and-white

Creeping Warbler was driven from the tree. A Red-eyed Vireo was not disturbed in the higher foliage. Three separate times while one Hummingbird was dipping another came. The effect was astonishing. Volleys of squeaks proceeded from both birds. They dropped directly downwards from the tree about twenty feet, and when close to the tops of bushes and brakes began to go backwards and forwards like a long pendulum, the trunk of the tree coming opposite the lowest point of their course, and the arc made by them measuring about forty feet. Their humming and squeaking were continuous. At the end of the performance only one bird was to be seen and he quietly perched in the tree. I think this oscillating flight was made five or six times in each of the three performances which I witnessed.

The following evening, July 25, I visited Orchard No. 2 again. One Sapsucker and two Hummingbirds were at work dipping between 7.20 and 8. P. M. The pendulum act was not performed. The Hummers were not disturbed by the Woodpeckers. They continued to dip until it was too dark for me to see them although I could hear their wings.

On the preceding morning after my visit to Orchard No. 2, I spent a short time at Orchard No. 1. I found the birch bark cups empty. I filled them and as I reached the ground the young Woodpecker came and began dipping from cup No. 3. He dipped ten times, then poked into two drills and flew away. The female came immediately after, dipped in a few drills, saw the fresh syrup, dipped ten times in cup No. 1, and flew away. That day and the 26th were rainy. On the 27th at 6.15 A. M. I saw a male Hummer working on evening primrose blossoms. He ignored other flowers. I reached Orchard No. 1 at 6.35. The young one was there. I filled cup No. 1, the others being torn or warped. A Hummer flew almost into my face while I was in the tree. About twenty new drills had been made since the 23d, all being higher up the trunk than previous ones. About two inches in height had been gained. I remained on the watch nearly nine hours, going away only for meals and a brief visit to Orchard No. 2. During the nine hours the male paid ten visits to the tree, the female four and the young one three. Forty-one visits were made by Hummingbirds, in several instances two were in the tree at once. The tree swarmed with insects, mainly large flies. One or more butterflies came. Early in the morning

I added brandy and sugar to the maple syrup in the cup. The Hummingbirds with one exception dipped only in the drills. In one case a Humming bird drank for sixty seconds (including a rest of ten seconds) from the cup. He then flew away. The young Sapsucker dipped only from the drills, the female dipped thirty times or more from the drills and twenty-five times from the cup. The male dipped fifty-four times from the drills and worked a little in deepening holes, drank sixty-six times from the cup and caught twenty insects some on the wing, some on the edge of the cup.

I noticed with surprise that the Hummingbirds in more than one instance took sap while clinging to the bark with their feet, their wings being at rest. I have been told by a careful observer that they cling to the trumpet flower in the same way while crowding themselves into its mouth to draw its sweets.

My notes refer again and again to the spiteful treatment of the Hummers at Orchard No. 1. On the other hand at Orchard No. 2 they say "Male and young one dipping. Hummer comes in and dips several times *between them* and they offer no objection."

In spite of the fact that one young bird had been shot from the family at Orchard No. 1 the tree was without Woodpeckers only about one hour out of the nine that I watched it on July 27.

On the 28th I arrived at Orchard No. 1. at 7.28 A. M. and watched it for two hours. On my arrival I filled one cup with brandy, sugar and syrup, and another, a new one, with pure brandy and a drop or two of the mixture on top. A Hummingbird's arrival at 7.30 brought the male Sapsucker from a neighboring tree. The Hummer was driven away. The Woodpecker dipped several times and then tried the pure brandy. He shook his beak and hitched away from the cup. Then he went out on the limb used as a regular point of departure and flew north, as my notes say: "pointing and flying as though for a long trip." At 8.13 a male Hummer drank forty seconds from the cup containing the brandy and syrup mixture. At 8.16 a female Hummer drank twenty seconds at the same cup. Both ignored the drills. At 8.42 a female Hummer while drinking was attacked again and again by the wasps and bees surrounding the tree and compelled to defend herself. At 9.05 the female Woodpecker arrived, dipped in a few holes and then went to the brandy cup. She drank

six times, then went out on the limb and presently began shaking her head violently, showering drops from her beak in every direction until she had thrown up what I estimated to be two teaspoonfuls of liquid. She flew away eastward but soon returned and remained until 9.30 when she flew north "as for a long trip."

I then hurried to Orchard No. 2 and remained there from 10.07 until 11.15. On some of the trees at this orchard a thick growth of small sucker branches was conspicuous just below the drills. I think it was caused by them. It served as a screen for the Sapsuckers. During this hour three Woodpeckers were at work dipping and occasionally catching some of the numerous insects of which the air was full. Seven visits were paid by Hummingbirds. One of the trees in use by the Woodpeckers, Hummers and insects was a red oak. The drills in it were very small and round. At 11.15 I went into a large swamp to the east of Orchards 1 and 2 in search of fresh evidence. After walking a quarter of a mile I paused and hooted like a Barred Owl. A young Sapsucker promptly appeared, and a moment later a Hummingbird, which alighted close to the Woodpecker. Seeing no Owl, the Hummingbird flew off towards the point from which the Sapsucker had come. I followed and found Orchard No. 3 consisting mainly of trees girdled long ago and now dead. The tree in use was a red maple. Its drills were about twenty-five feet from the ground. One bird was dipping; two more came soon after. After a brief stay I went home to dinner. Returning at 2.45 I stayed until 4.15. A Downy Woodpecker passed without going to the drills. At 3.35 I killed two young Woodpeckers with a single charge of dust shot. A few moments later a Hummingbird alighted in one of the dead maples. At 4.10 I was drawn away by the hooting of a Barred Owl and did not return to Orchard No. 3 until Aug. 7 when I found only one Sapsucker at work, a young one, which I shot. I do not think that I found the principal trees in this orchard.

I ended my observations of July 28 by a visit of twenty-five minutes at 'Orchard No. 4' which I had first seen three years before. It consisted of a large number of dead and a few living trees which stood on a delta formed by the Chocorua River at its point of union with Chocorua Lake. The part of the orchard in use was a birch from whose root rose four major trunks quickly subdividing into fifteen minor stems each rising to a height of

over thirty feet. All of these fifteen trunks were dead or dying. Only seven of them bore leaves. I reached this orchard at 6.25 P.M. and finding no birds in sight placed Puffy on a stump close to the drills which were only seven to nine feet from the ground. Instantly a Hummingbird appeared, buzzing and squeaking, and the next moment a female Sapsucker came into the tree scolding. I removed Puffy and soon after the Hummingbird began dipping, giving a squeak each time he dipped. At 6.50 the Hummer, again discovering Puffy, flew within ten inches of his eyes, buzzed indignantly and flew away.

On Aug. 5 from 3 to 4 P. M. no Sapsuckers came to Orchard No. 4 and only one Hummer. A high wind was blowing.

On August 7 I visited Orchard No. 1. About twenty new holes had been made since July 28 and great quantities of frothy sap were wasting. The sap was as sweet as though artificially sweetened. I saw one young Sapsucker and one Hummingbird; neither of them dipped. The Woodpecker caught several insects.

On Aug. 8 I reached Orchard No. 4 at 6 A. M. At 6.03 a Hummer came. At 6.06 a young Sapsucker came and began dipping. I had with me, instead of one of my Barred Owls, one of three young Screech Owls which Mr. Batchelder had confided to my care for the season. 'Scops' was placed in a conspicuous position in the heart of the orchard. The Sapsucker had scarcely begun dipping when he saw the Owl and raised the alarm. Over thirty birds came, including two Hummers. By 6.30 the noise subsided, and the Sapsucker, who had not left the tree at all, resumed his dipping. A male Hummer was also dipping at 6.31. At 6.42 the Sapsucker was dipping within seven feet of my head, and the Hummer was perched close by. At 6.47 the Hummer buzzed in Scops' face and then perched again. At 6.52 another Hummer came and both flew away, at 6.54 both came back, but went again. At 6.56 Scops, whose wing was clipped, jumped nearly six feet at the young Sapsucker, at whom he had been glaring for some time. The Woodpecker flew with a loud cry, scolded for a long time and then disappeared. I nailed a birch bark cup to one of the stems and while doing it a Hummer came and looked at me. Later, he came again, looked at the cup and dipped at drills close above it.

I spent from 10 A. M. until 12.34 at Orchard No. 2 for the

purpose of shooting all Sapsuckers seen there. I found last year's tree again in use and those in use July 24 and 25 temporarily abandoned. From 10 to 10.48 the Sapsuckers seen spent all their time catching insects on the wing, sometimes flying fifty feet for them. Hummingbirds were numerous, and, as I had noticed was the case with this orchard, were unmolested even when dipping within a foot of a Sapsucker. At 11.15 I fired while a Hummer and young Sapsucker were both dipping and and killed the Woodpecker.

At 11.47 I tried again and killed a Sapsucker and male Hummer with the same charge. At 12.12 a female Hummer came and dipped for forty seconds. At 12.27 I shot another young Sapsucker and at 12.34 a fourth. As I left the orchard a female Hummer was dipping.

On August 10 I spent from 5.30 P. M. until 6.30 at Orchard No. 4. A young Sapsucker and Hummer were in the drilled tree during the entire hour. Although I climbed into the tree to put maple syrup in the cup, the Woodpecker did not leave the branches. Neither bird took any syrup.

On Aug. 13 I reached Orchard No. 2 at 6.40 A. M. At 7.09 a Hummer buzzed in my face so near that I was startled and waved her off. At 7.15 a Hummer was dipping in a canoe birch near by. At 7.17 I fired at her but missed. She dipped again at 7.29. At 7.32 I fired again and failed. At 7.37 she was dipping again and then perched near by. She dipped again at 7.45 and 7.49 and I tried a third shot which was successful. At 7.58 a female hummer was dipping in the same spot. At 8.07 I left without having seen a Woodpecker but with the certainty that more than a single pair of Hummers used Orchard No. 2.

On Aug. 14 at 3 P.M. Hummingbirds were using Orchard No. 2 but the supply of sap was diminishing and no Woodpeckers were to be seen. I shot away a small limb which I noticed the the Humming birds perched upon, and a few moments later one returned and flew in zigzag lines near the spot, searching for the missing twig. The same or another bird repeated the search a few minutes later. At 4 P. M. I reached Orchard No. 1 which seemed deserted, nothing coming during an hour and a half. Great streams of frothy sap extended down the bark to the ground and formed a moist spot on the leaves and mould. The trees smelled sour and the lower sap tasted sour. I climbed to the

drills. The upper holes were blowing bubbles of sap, and a slow current was flowing from them, readily visible to the eye. Many kinds of insects were upon the trunk, including ants, common house flies, and hornets. One of the last named stung me without other provocation than my presence, and I descended rapidly from the tree. By a mark made on July 23 I was able to determine that in three weeks the drills in this red maple had been carried eight inches up its trunk.

On Sept. 5 I paid a final visit, for the season, to Orchard No. 1. There were no birds present between 2.30 and 3 P. M. But little sap was flowing. The tree looked in better condition than in July or August.

Great numbers of hornets were in control of the tree. A few butterflies hovered near, but were driven away by the quarrelsome hornets.

On May 1, 1891, I took advantage of a brief trip to Chocorua to visit Orchard No. 1. The Sapsuckers were there and had evidently been at work several days. The red maple, their principal tree, was covered with flowers above the belt of drills, and with newly opened leaves on its lower limbs. The female was dipping at a series of new drills which had been opened two feet above the old belt. Forty-three holes had been cut on the trunk and nearly as many more on several adjoining limbs. Sap was flowing from the upper holes only, and not in abundance. It was slightly sweet. The male came to the tree once during my stay of half an hour, but he spent most of his time on a poplar a few rods distant, where he was digging his family mansion. The poplar was a vigorous tree, about forty feet in height. The hole was on the southeast side of the trunk a little more than twenty feet from the ground. It seemed to be already four or five inches deep. The birds were noisy, especially so when the female went to inspect the male's digging, and when the male came for a moment to the drills. Only two Sapsuckers appeared, and no Hummingbirds were to be seen. There were practically no insects to be found near the drills.

During July and August, 1890, I shot in all eight Sapsuckers at the various orchards. I preserved their stomachs which were well filled with insects. Some of these stomachs were examined by Professor Hagen who wrote to me on Aug. 21st as follows:

"The Woodpecker has hashed his food so fine, that it is beyond

my power or knowledge to determine accurately the composition of this bug-hash."

Mr. Samuel H. Scudder was able to speak with more confidence of the stomachs which I sent to him. Under date of December 19 he said: "The insects in the different stomachs are in all cases almost exclusively composed of the harder chitinous parts of ants In a cursory examination I find little else, though one or two beetles are represented and No. 4 must have swallowed an entire wasp of the largest size, his head and wings attesting thereto. If the birds were very different in habit, or presumably in food, a comparison of the kinds of ants might lead to the detection of some peculiarities. A number of species are represented."

It is worthy of note that the structure of the tongue of this species is somewhat unlike that of the tongues of other Woodpeckers. In form it is not adapted to use as a dart for securing insects and its fringed edges have suggested to biologists who were not observers of the bird's habits, that sap might, as in the cases of species with similar apparatus, form an important portion of its food. The following extract from a letter written to me by Mr. W. F. Ganong, Instructor in Botany at Harvard University, gives a clear history of the progress of sap in its ascent and descent.

"It is now thought by botanists that the elaborated sap from the leaves is transferred down the stem through the soft bast cells of the inner bark, just outside of the cambium layer. It hence passes to the medullary rays, where it is stored up to last over the winter in the form of starch chiefly. Some of it is stored also in the wood cells of the young wood—but none I believe in the ducts or fibres or main masses of the wood itself. In the latter there is a current of crude sap from the roots flowing up, but I do not think any botanist thinks that the elaborated sap flows down by the same path. Hence if the Woodpecker in July or August penetrates the *wood*, he would get only crude sap from the ordinary wood tissue, but he might get elaborated sap from the medullary rays or some of the smaller wood cells—much more of the former (*i.e.* unelaborated) than of the latter (*i. e.* elaborated), I should say. If he penetrates to the cambium only he would get elaborated sap (which is being transformed into tissue), and if he penetrated the soft inner bark only he certainly would

get elaborated sap flowing downward, and probably that only. If it is elaborated sap he wants, he would do much better to go no further than the inner bark and cambium. The medullary rays are so small in proportion to the size of a Woodpecker's bill and tongue that he would receive but poor wages for his labor in penetrating them. Of course in spring before the leaves are fully out, the sap is very rich as it flows up, both in starchy and albuminoid matters, and *then* it would be worth working for. But as late as July and August, the upward flowing sap, while it contains traces of these nutritious substances, must be very poor in them.

"I never thought of the question before, because I did not know that Woodpeckers bored for sap. I always supposed it was insects and their larvæ they were after."

Summary.— From these observations I draw the following conclusions: that the Yellow-bellied Woodpecker is in the habit for successive years of drilling the canoe birch, red maple, red oak, white ash and probably other trees for the purpose of taking from them the elaborated sap and in some cases parts of the cambium layer; that the birds consume the sap in large quantities for its own sake and not for insect matter which such sap may chance occasionally to contain; that the sap attrac s many insects of various species a few of which form a considerable part of the food of this bird, but whose capture does not occupy its time to anything like the extent to which sap drinking occupies it; that different families of these Woodpeckers occupy different 'orchards,' such families consisting of a male, female and from one to four or five young birds; that the 'orchards' consist of several trees usually only a few rods apart and that these trees are regularly and constantly visited from sunrise until long after sunset, not only by the Woodpeckers themselves, but by numerous parasitical Hummingbirds which are sometimes unmolested, but probably quite as often repelled; that the forest trees attacked by them generally die, possibly in the second or third year of use; that the total damage done by them is too insignificant to justify their persecution in well-wooded regions.